CLAIMS:

1. A two-electrode optical electromechanical shutter comprising:

a substrate;

a membrane originally resting on four pillars above said substrate; said membrane being composed of the following elements:

a first conducting electrode facing said substrate and attached to two pillars of said four pillars through torsion hinges made from the same material as said conducting electrode; said first conducting electrode is placed at the membrane edge in the shape of a stripe parallel to said membrane edge and has the width equal or less than the depth of the air gap existing between said substrate and said membrane, so that said membrane is capable of rotating around said torsion hinges and reaching position normal to the substrate plane;
a layer of insulator above said conducting electrode;
a top layer on said insulator.

a second conducting electrode placed on said substrate underneath said first conducting electrode on said membrane and made as a stripe parallel to said first conducting electrode, so that under application of appropriate potential difference between said first and second conducting electrodes said membrane can move to the position normal to said substrate plane;

output conductive lines connected to said first and second conductive electrodes for application of a voltage to the shutter.

2. The shutter of Claim1 wherein said torsion hinges are made within the membrane area by cutting notches through said membrane to form narrow and flexible belts extending to said two pillars of said four pillars.

3. The shutter of Claim 1, wherein the resilient properties of said torsion hinges are properly adjusted to produce effect of shutter bi-stability, when the potential difference between said first and second conductive electrodes needed to rotate said membrane into its final position normal to the substrate plane is significantly larger than the potential difference between said first and second electrodes needed to maintain said membrane in said final position.

4. The shutter of Claim 3, wherein said substrate is made from glass.

5. A display comprising a two-dimensional array of the shutters of Claim 3 which form a matrix of pixels, wherein said first conductive electrodes of all shutters in every vertical array are connected to a column conductive line and said second conducive electrodes of all shutters in every horizontal array are connected to a row conductive line, so that every pixel in the display is associated with a particular pair of said column and row lines to selectively apply voltage to the pixel located at the intersection of these lines.

6. The display of Claim 5, wherein the operation of the display activation to produce an image is followed by holding all pixels in the display at a constant voltage, which is lower than the voltage needed to transfer pixel into the "on"- state.

7. The display of Claim 6, in which for reflecting mode of the display operation the substrate is blackened and absorbs light, while said top layer on said insulator is a white color powder to enhance the contrast ratio.

8. The display of Claim 6, in which for reflecting mode of the display operation the substrate is blackened and absorbs light, while said top layer on said insulator is made as a light reflective metal to enhance the contrast ratio.

9. The display of Claim 6, wherein for reflective mode of the display operation the substrate is coated with a white color film, while said top layer on said insulator is a black powder to absorb light and increase the contrast ratio.

10. The display of Claim 6, wherein for transmissive mode of the display operation the substrate is made from a transparent material to pass light in the "on"-state, and said top layer on said insulator is a black powder, to absorb light and thus increase the contrast ratio.

11. The method of fabrication of the display of Claim 6 comprising the following steps:

providing the substrate;
metal deposition, photolithography patterning and metal etching to form said second conductive electrode and said row lines;
deposition of the first sacrificial layer, photolithography patterning and etching to fabricate said four pillars;
deposition of the second sacrificial layer;
electromechanical etching to produce flat top surface with thickness of said second sacrificial layer equal to height of said four pillars;
metal deposition, photolithography patterning and etching to form said first conducting layer and said column lines;
deposition of said layer of insulator;
deposition of said top layer on said insulator;
photolithography patterning and etching of said top layer on said insulator and said layer of insulator to form said membranes;
plasma etching of said second sacrificial layer to form pixels.

12. A three-electrode electromechanical shutter comprising:

a substrate;

a membrane originally resting on four pillars above said substrate; said membrane being composed of the following elements:

a first conducting electrode facing said substrate and attached to two pillars of said four pillars through torsion hinges made from the same material as said conducting electrode; said first conducting electrode consists of three conducting pieces:

the first piece is placed at the membrane edge in the shape of a stripe parallel to said membrane edge and has the width equal or less than the width of the air gap existing between said substrate and said membrane, so that said membrane is capable of rotating around said torsion hinges and reaching position normal to the substrate plane;

the second piece in the shape of a stripe of the same width as said first piece is placed in the middle of said membrane parallel to said first piece;

the third piece in the shape of a stripe is placed normally to said first and second pieces and connects said first and second pieces into a single said first conducting electrode;

a layer of insulator above said conducting electrode;

a top layer on said insulator;

a second conducting electrode placed on said substrate underneath said first piece of said first conductive electrode on said membrane and made as a stripe parallel to said first piece;

a third conducting electrode placed on said substrate underneath and parallel to said second piece of said first conducting electrode;

output conductive lines connected to said first, second and third conductive electrodes for application of voltages to the shutter.

13. The shutter of Claim 12 wherein said torsion hinges are made within the membrane area by cutting notches through said membrane to form narrow and flexible belts extending to said two pillars of said four pillars.

14. The shutter of Claim 12, wherein the resilient properties of said torsion hinges are properly adjusted to produce effect of shutter bi-stability, when the potential difference between said first and second conductive electrodes needed to rotate said membrane into its final position normal to the substrate plane is significantly larger than the potential difference between said first and second electrodes needed to maintain said membrane in said final position, while no potential difference is applied between said first and third conducting electrodes.

15. The shutter of Claim 12, wherein said substrate is made from glass.

16. The shutter of Claim 12, wherein said first and second conductive electrodes are made from metal.

17. The shutter of Claim 12, in which for the reflecting mode of the shutter operation the substrate is blackened and absorbs light, while said top layer on said insulator is a white color powder or paint to enhance the contrast ratio.

18. The shutter of Claim 12, in which for reflecting mode of the shutter operation substrate is blackened and absorbs light, while said top layer on said insulator is made as a light reflective metal to enhance the contrast ratio.

19. The shutter of Claim 12, wherein for reflective mode of the display operation the substrate is coated with a white dielectric, while said top layer on said insulator is a black powder.

20. The shutter of Claim 12, wherein for the transmissive mode of the shutter operation the substrate is made from a transparent glass to pass the light in the "on"-state, while said top layer on said insulator is a black powder.

21. A display comprising a two-dimensional array of the shutters of Claim 13 which forms a matrix of pixels, wherein said first conductive electrodes of all shutters in every vertical array are connected to a column conductive line and said third conducive electrodes of all shutters in every horizontal array are connected to a row conductive line, while all said second conductive electrodes on said substrate are grounded.

22. The display of Claim 21, wherein the operation of the display activation to produce an image on the screen is followed by holding all pixels in the display at a constant voltage, which is lower than the voltage needed to transfer pixel into the "on"- state.

23. The display of Claim 22, in which for reflecting mode of the display operation the substrate is blackened and absorbs light, while said top layer on said insulator is a white color powder to enhance the contrast ratio.

24. The display of Claim 22, in which for reflecting mode of the display operation the substrate is blackened and absorbs light, while said top layer on said insulator is made as a light reflective metal to enhance the contrast ratio.

25. The display of Claim 23, wherein for reflective mode of the display operation the substrate is coated with a white dielectric, while said top layer on said insulator is a black powder to absorb light and increase the contrast ratio.

26. The display of Claim 23, wherein for transmissive mode of the display operation the substrate is made from a transparent glass to pass light in the "on"-state, while said top layer on said insulator is a black powder, to absorb light and thus increase the contrast ratio.